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LG Fault Detection on Transmission Line

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***Abstract*— An electrical power system can be sectioned as a Generation system, Transmission system, Distribution system along with utilization for better understanding of the system to achieve simplicity in studying the system and provide the better control to the system. It is necessary to provide uninterrupted supply to the consumers and maintain the continuity to make the system more reliable. Transmission lines are the major part of the transmission system which transmits electric power from generating stations to the primary distribution centers. Due to various reasons any abnormal condition, commonly known as term FAULT is occur on transmission line which breaks the continuity of the supply. Detecting, Locating and Clearing the fault is required to maintain the supply continuity. This paper proposes technique for detection of LG fault and send alert for the same for fast action of fault rectification by using microcontroller, LED, buzzer, LCD and GSM module to detect the LG fault on the transmission line.**

Keywords—Power system, LG Fault, transmission line, microcontroller, LCD, GSM module.

I. INTRODUCTION

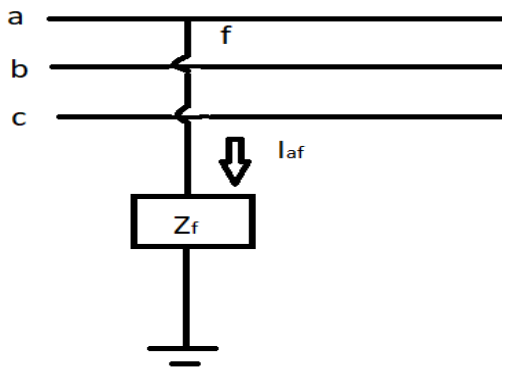
Transmission line performs significant role in the electric power system. When the fault occurs on the transmission line due to various reasons such as lightning and other reasons, power system is unable to maintain its stability and performance.[1][4] Under normal operating working conditions that is when there is no fault in the system, all equipment operate at normal current and voltage rating but once the fault occur on the transmission lines then there is change in voltage and current values which is hazardous and can be leads to introduce severe damage.

[1] The number of studies shows that nearly 70-90% faults occurred on the transmission lines are caused by mainly insulator flashover and which are most likely to be transient faults. Other than these faults there are various types of the faults.

[1][2] Types of Faults on the transmission Line:

1) Shunt Fault:
   a) LG Fault
   b) LL Fault
   c) DLG Fault
   d) Symmetrical or Balanced Fault
2) Series Fault:
   a) One conductor open fault
   b) Two conductor open fault

Among all the above faults, LG faults are most frequently occurred on transmission lines which is one of the types of shunt fault. Nearly about 85-90% of the faults are LG type faults.[1] When the single conductor touches the ground or comes in contact with the neutral conductor then this phenomenon is known as LG or SLG faults. The common cause behind presence of this fault in the system is falling any heavy object like tree on the one of the line due to storms. Fig (1) shows the scenario when LG fault occur on transmission line 'a'.



fig(1). LG Fault

[2][3] Previously there are various methods are used for the purpose of fault detection and locating on the transmission lines such as,

1) Use of microprocessors
2) Short circuit analysis
3) Visual inspection of transmission lines
4) Consumers/ Passerby's call.

The paper presents design and implementation of the technique of detection and locating LG type fault on transmission line using microcontroller and alert about the LG fault by using buzzer and GSM communication module.

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II. BLOCK DIAGRAM

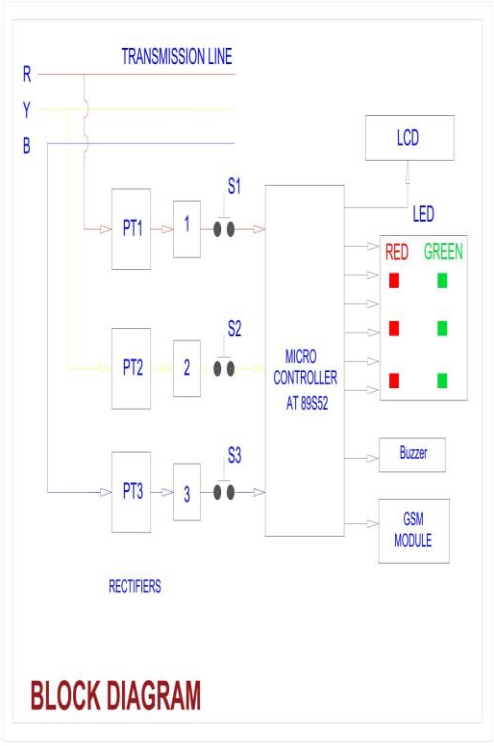

Fig (2). Block Diagram

Fig (2) shows the block diagram of hardware design implanted to detect and locate the LG fault.

Transmission line consists of three conductors or say lines denoted by R, Y and B.

Potential transformers PT1, PT2 and PT3 are connected across conductors R, Y and B respectively. Potential transformers steps down the voltage in respective line mostly for measuring purpose. Here we are 9-0-9 transformer which steps down the 230v to 9v.

This supply then given to the rectifier. In rectifier circuit, rectifier didoes are arranged in such a way that it conducts for positive and negative half cycle and gives the rectified dc output. Three rectifier circuits 1, 2 and 3 are used in each line R, Y and B respectively.

This Dc voltage is then given to the Microcontroller via active low switches S1, S2 and S3. Active low switches indicates that the circuit or we can say the signal is going to perform assigned function only when its logic level. By pressing this switch creates the same effect as line to ground fault on the line.

In normal working condition, Microcontroller AT89S6 is fed by continuous constant 5v supply through each line R, Y and B. When the switch is pressed it creates the effect similar to the line to ground fault which is sensed by microcontroller.

LED section is consisted of six LEDs, three red LEDs and remaining three are Green. Green LEDs are continuously glowing in normal operating working conditions. When the switch is pressed in any line then respective Green LED turn OFF and respective Red LED turn ON to indicate that there is LG fault occur on that particular line.

Buzzer alters the nearby people about presence of the fault to ensure that everyone can follows proper safety measures before coming near to the faulted line.

LCD shows the fault occurrence on the line after fault is detected by microcontroller otherwise it continuously displays system name.

This paper implies the use of GSM communication module to notify about presence of LG fault on the lines. Microcontroller detects the fault and send signal to the GSM communication module which send SMS to the regarding person for taking fast action to rectify the fault.

III. COMPONENTS USED

1. Microcontroller AT89S52.
2. Sim900a GSM Communication Module.
3. 16x2 LCD
4. Centre tapped potential transformers.
5. Rectifier circuits consist of diodes.
6. Active low switches.
7. Buzzer
8. Resistors
9. Capacitors
10. PCB

IV. HARDWARE CIRCUIT DESIGN

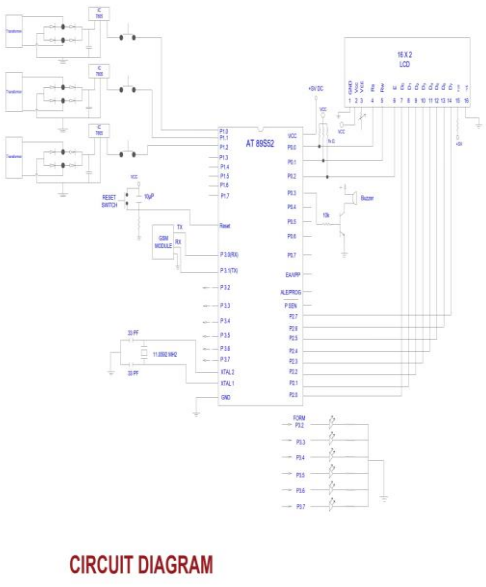

Fig (3). Hardware Circuit Design.

Fig (3) shows the hardware circuit design of the model. Microcontroller is central and most important part of the proposed technique model.

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The AT89S52 is 8-bit microcontroller with 8 kB of in system programmable flash memory with three timers and having 32 I/O pins.

The entire circuit divided into two sections referring microcontroller-

a) INPUT SECTION-

Input section of the circuit contained center tapped transformers, rectifier circuit, Voltage regulators, Switches and Filtering capacitors. This section works on detecting of fault.

9-0-9 Center tapped transformer provides output voltage of 9v if connected across one end terminal and center (0v) and of 18v if connected across two end terminals. Here its fed between one end and center and gives 9V output.

Input to the rectifier is ac, rectifier convert it into dc. One rectifier circuit has four diodes and arranged such way that it gives full wave rectified dc output. The rectified output dc is not smooth as required hence capacitor is connected for removing impurities from dc voltage.

Voltage regulators, as its name suggests, provides constant voltage throughout the operation continuously. IC 7805 ensure that positive 5v is constantly provided to the microcontroller without any interruption. IC 7805 has three terminals. Dc voltage is an input to the IC, second (ground) terminal is grounded and third terminal (output) provides constant 5v to the Microcontroller.

Switches S1, S2 and S3 are active low type and it interrupts the continuous supply from voltage regulator which results into creating LG fault.

b) NOTIFYING SECTION-

Notifying section included LEDs, Buzzer, 16x2 LCD, GSM communication Module. Which notify about the LG fault presence in the system.

Green LEDs are glowing when system is working smoothly without any interruption. When switch pressed it interrupts the supply and respective Green LED will turn OFF and respective Red LED will turn ON indicating that there is a fault on the transmission line.

Buzzer makes beeping sound to alert surrounding about fault occurrence on the transmission line. The npn transistor provides required switching action.

16x2 LCD displays the fault occurred after pressing switch otherwise it displayed name of the system. LCD named such way because it has 16 columns and two rows to display the characters. 16x2 LCD has 16 pins.

Pin 1 name is ground. It is a source pin and connected to ground.

Pin 2 name is VCC. It is source pin and connected to the positive supply.

Pin 3 name is VEE. It is a control pin and used to adjust the contrast of the LCD.

Pin 4 name is Register Select. It is a control pin and it selects command mode if signal is 0 and data mode if signal is 1.

Pin 5 name is Read/Write. It is a control pin and it selects to write if the signal is 0 and selects to read if signal is 1.

Pin 6 name is Enable. It is a control pin it must be high to start to perform the desired operation and during performing the operations.

Pin 7 to Pin 14 are Data lines.

Pin 15 is LED positive for backlight.

Pin 16 in LED negative for backlight.

GSM communication module Sim900a connected to microcontroller such as Rx pin of microcontroller to the Tx pin of GSM Module and vice versa.[4] GSM module and microcontroller both works on +5v supply but for serial communication 12v supply is required for this purpose MAX 232 IC is used.

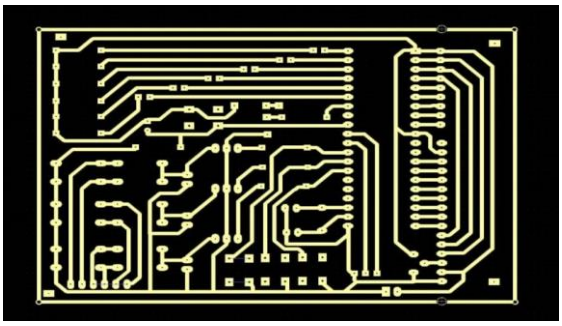

Fig (4). PCB design

V. PROPOSED METHODOLOGY

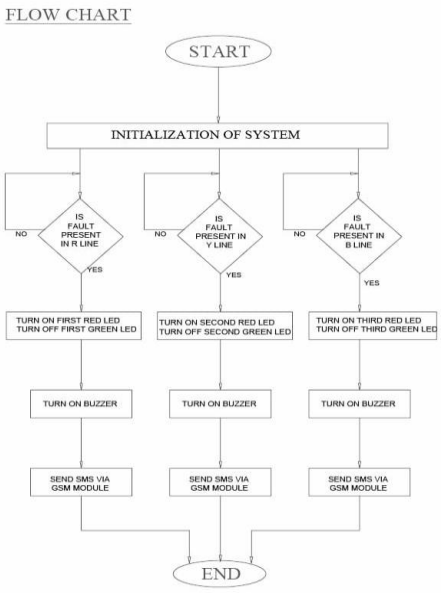

Fig (5). Flowchart for the functioning of the hardware model.

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After starting the proposed system first step is to initialize the system then three subroutines are provided which runs one after another.

1) First it checks for the choice has been given ‘if the fault present in the R line’ if this is true then system turn OFF the green LED 1 and turn ON the Red LED1. Then sends signal to start the buzzer and GSM Module send SMS to the number given in program. Subroutine ends.

2) Then it checks for the second choice has been given ‘if the fault present in the Y line’ if this is true then system turn OFF the green LED 2 and turn ON the Red LED 2. Then sends signal to start the buzzer and GSM Module send SMS to the number given in program. Subroutine ends.

3) Then it checks for the choice has been given ‘if the fault present in the B line’ if this is true then system turn OFF the green LED 3 and turn ON the Red LED 3. Then sends signal to start the buzzer and GSM Module send SMS to the number given in program. Subroutine ends.

And program ends here. Proposed model provided with Reset switch to start the program again from first step.

VI. RESULTS

Sr No	Switch	LED Glow	LED OFF	LCD	GSM SMS
1	None	L1 L3 L5	L2 L4 L6	No fault detected	None
2	S1	L2 L3 L5	L1 L4 L6	Fault detected	LG fault on R line between pole 8-9
3	S2	L1 L4 L5	L2 L3 L6	Fault detected	LG fault on Y line between pole 8-9
4	S3	L1 L3 L6	L2 L4 L5	Fault detected	LG fault on B line between pole8-9

Table 1

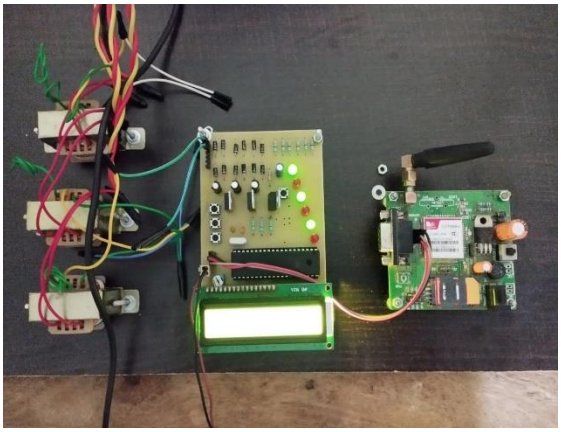

Fig (6) Implementation of hardware design at normal operating conditions.

Fig (7). LCD under normal working condition,

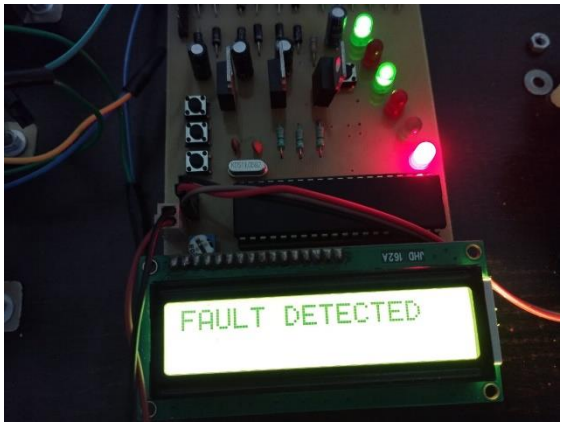

Fig (8) When LG fault occur on R line.

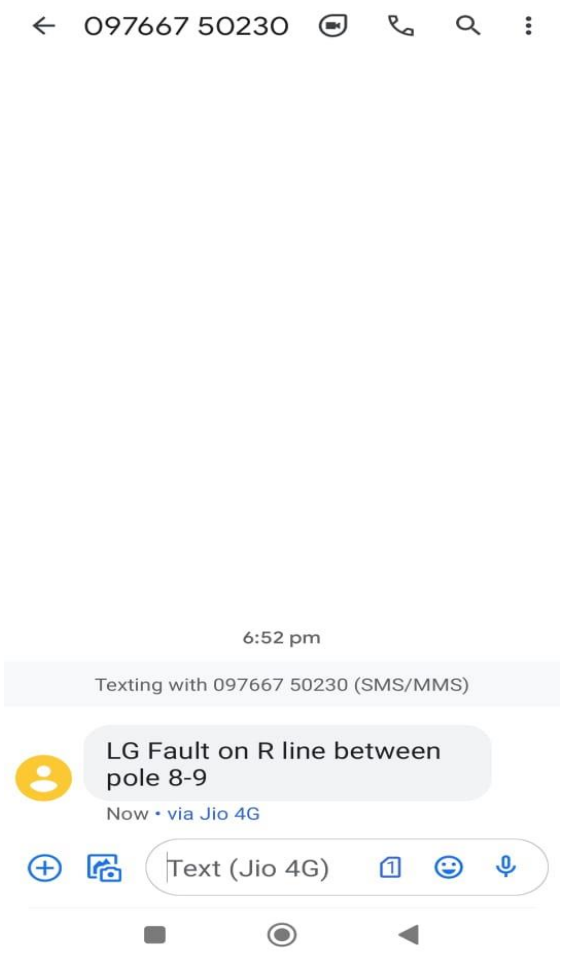

Fig (9). SMS alert by GSM module when fault occurred on R line.

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VII. ADVANTAGES AND FUTURE SCOPE

The proposed system uses electronic components which has small size which make the system circuit compact and handy. Use of microcontroller ensures that system works and responds precisely. Using proposed system LG fault detection and locating is fast accurate. GSM module send SMS after fault occurrence which ensures that saving the time and energy for fault detection and locating.

This paper suggests detection of LG fault. We can apply similar technique for LL, LLL, DLG faults. It needed to be mount on transmission tower, the compact size of circuit will make this process easier. The transmission tower provided by numbers thus one can determine exact location of fault. It also has potential to using in fault clearing techniques.

VIII. CONCLUSION

Proposed system is concerned with overhead transmission lines. It suggests the way to detect and locate the LG type fault on the transmission line. Microcontroller compares the input if there is disturbance the it will send signal to the buzzer to turn on. Glows the respective red LED and turn OFF respective green LED. Displays about the presence of LG fault on LCD. GSM module send SMS to the regarding person to fast action to be taken to rectify the fault.

IX. ACKNOWLEDGEMENTS

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